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ABSTRACT

A confirmatory factor analysis was used to determine the respective viability of factor structure models for the Wechsler Adult Intelligence Scale-Revised (WAIS-R) standardization data. The traditional verbal-performance split was compared to an alternative model proposed by Gutkin, Reynolds and Galvin. The confirmatory analysis indicated that the Gutkin model provides a superior fit to the data at all age levels and for the total samples. In addition, the results from Gutkin model analyses at each age level were iterative, yielding a refinement in the respective age specific fits of the model. Clinicians should take this finding into account when scoring WAIS-R results. (Author)

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Confirmatory Factor Analysis of the WAIS-R: Plausibility of Models

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Confirmatory Factor Analysis of the WAIS-R:

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Running head: WAIS-R

Confirmatory Factor Analysis of the WAIS-R:

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School psychologists' interest in the measurement of adult intelligence has increased substantially in the last few years. Indicative of this trend are the findings of Goh, Teslow, and Fuller (1981) who reported, based upon a national survey, the Wechsler Adult Intelligence Scale (WAIS) (Wechsler, 1955) to be among the intelligence tests most frequently used by school psychologists. Factors reinforcing the growing popularity of the WAIS include PL 94-142 mandates to serve handicapped individuals through age 21; the growing focus of school psychology on secondary schools, adults, and vocational services (Carroll, Harris, & Bretzing, 1979; Hohenshil, 1979); and the rich history of research supporting the reliability and validity of this instrument (see Matarazzo, 1976, for an extensive literature review). The recently published WAIS-R (Wechsler, 1981) will quickly become an instrument of major significance for school psychologists, as the heir apparent to the WAIS.

As with all the Wechsler scales, factor analytic research provides a major empirical foundation upon which to base interpretations of WAIS-R test results (Kaufman, 1982; Kaufman & Reynolds, in press). Among the most crucial psychometric and clinical issues addressed by factor analyses of Wechsler scales is the validity of the Verbal (VIQ) and Performance (PIQ) IQ.

Using the WAIS-R standardization data, Silverstein (1982) conducted an exploratory, orthogonal factor analysis with a varimax rotation, concluding that the VIQ and PIQ were appropriate measures of the verbal and performance factors, respectively. Gutkin, Reynolds, and Galvin (in

press), analyzing the same data with the same statistical techniques (in addition to an oblique rotation), reported that the verbal and performance factors were inadequately measured by the VIQ and PIQ in most instances. They suggested the most appropriate measure of the verbal factor could be obtained by calculating a Verbal Comprehension Deviation Quotient (VCDQ) composed exclusively of the Information, Vocabulary, Comprehension and Similarities subtests. Similarly, they recommended the computation of a Perceptual Organization Deviation Quotient (PODQ), consisting only of the Block Design and Object Assembly subtests, to measure the performance factor.

As recommended by Kroonenberg and Lewis (1982), confirmatory factor analysis (Joreskog & Sorbom, 1978) is the proper approach for determining which of several factor analytic models best fit a set of data. For the purposes of the current study, this technique was employed to assess the validity of the VIQ and PIQ, and to determine whether the Silverstein (1982), Gutkin et al. (in press), or alternative interpretation of the WAIS-R standardization data was most appropriate. The results of this study have substantial implications for all psychologists using the WAIS-R with normal and clinical populations.

Method

Subjects

Data from the WAIS-R standardization sample were utilized for this study. Stratified by age, sex, race, geographic region, occupation, education and urban-rural residence, this 1,880 person sample is representative of the American adult population as reported in the 1970 census and more recent updates (Wechsler, 1981).

Analysis

A confirmatory factor analysis was used to discern the respective viability of factor structure models for the WAIS-R. The analysis was achieved by using the LISREL IV program (Joreskog & Sorbom, 1978). Two specific models were considered for each of the age groups as well as for the total sample. First, the traditional Wechsler Model (Wechsler, 1981), specifying a two factor structure, verbal and performance, with information digit span, vocubulary, arithmetic, comprehension, and similarities comprising the verbal factor and picture completion, picture arrangement, block design, object assembly, and digit symbol completing the performance factor, was considered. Second, the Gutkin Model (Gutkin et al., in press) was examined. This model also specifies a two factor structure; however, the number of subtests identified as comprising each factor is reduced, i.e., verbal: information, vocabulary, comprehension, and similarities; performance: block design and object assembly. In addition to the series of analyses which considered the plausibility of the two models identified above, the results of the superior model identified by this previous analysis were iterated, by freeing parameters as identified in the sequence of the LISREL analyses, to obtain a variation on the model at each specific age level which would provide a more comprehensive fit to the data. For the superior model, successive model fit statistics (X^2 goodness of fit) were tested for significance. Optimal age specific models were adopted when nonsignificant successive fits were identified.

Therefore, the analyses consisted of two phases. Phase I compared the respective plausibility of two factor structure models for the WAIS-R for each of the nine age groups as well as for the total sample. In Phase II, the results of the superior model obtained from the initial confirmatory factor analyses were iterated to obtain a more optimal model at each age level and for the total sample.

Results

Phase I

Table 1 displays the goodness of fit X^2 values and their respective probability values for the two models (Wechsler and Gutkin) for all nine age levels and for the total group. The magnitudes of the X^2 values and their respective probability values suggest that the Wechsler Model overfits the data at each age level and for the total sample. The Gutkin Model, on the other hand, while still presenting probability values indicative of more than sufficient fit, represents a more reasonable fit throughout the age levels, particularly for age levels 16-17, 55-64, 65-69, and 70-74. At all age levels, though, the fit of the data to the Gutkin Model is greater than would be deemed sufficient. It is important to note that generally speaking, probability values greater than .10 are considered desirable for the magnitude of the probability from the X^2 goodness of fit statistic for confirmatory factor analyses (Kroonenberg and Lewis, 1982).

Phase II

The Gutkin Model was submitted to an iterative analysis to refine the factor structure to obtain a more satisfactory fit at each age level

and for the total group. The results of the iterative analyses at each of the nine age groups and the total sample are shown in Table 2. These iterated models are simply refinements of the "raw" Gutkin model and the fit statistics indicate that some improvement in fit was indeed achieved at each age level and for the total group.

Discussion

The results of this study clearly suggest that the Gutkin Model provides a superior fit to the WAIS-R standardization than does the traditional Wechsler Model. This finding is consistent across all age levels and for the total sample. Based on these results, clinicians interpreting WAIS-R scores would be advised to utilize the Gutkin factor structure model as identified in Gutkin et al. (in press). Specifically, the Verbal factor appears to be better measured by the Information, Vocabulary, Similarities and Comprehension subtests while the Performance factor is better measured by the Block Design and Object Assembly subtests.

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Table 1

X^2 Goodness of Fit Values for

Wechsler and Gutkin Models

Age groups	Model			
	Wechsler	p	Gutkin	p
16-17	96.79	.00001	60.06	.02
18-19	115.20	.00001	75.16	.0003
20-24	117.84	.00001	75.60	.0003
25-34	142.07	.00001	107.16	.00001
35-44	149.38	.00001	78.37	.0001
45-54	150.24	.00001	94.66	.00001
55-64	111.48	.00001	64.19	.005
65-69	90.59	.00001	63.30	.006
70-74	80.56	.00001	67.41	.002
total	905.70	.00001	742.85	.00001

Table 2

X^2 Goodness of Fit (degrees of freedom) and probability values for Iterated Gutkin Models

Age Group	Gutkin	
	X^2(df)	p
16-17	39.14(36)	.33
18-19	39.30(34)	.24
20-24	42.42(36)	.21
25-34	33.65(31)	.34
35-44	41.68(34)	.17
45-54	38.96(34)	.27
55-64	47.22(37)	.12
65-69	36.00(33)	.34
70-74	43.17(35)	.16
total	33.23(27)	.19